OSCILLATIONS OF DECAMETER TYPE IV BURSTS OBSERVED ON APRIL 7, 2011

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Introduction

The new branch of solar physics known as solar seismology (Nakariakov & Verwichte, 2005) reaches a huge progress last ten years. Since observations of oscillations and pulsations of different coronal structures (such as magnetic loops, prominences) become possible at the optical, x-ray and radio wavelength ranges with spacecrafts (TRACE, SOHO, SDO, etc). Analysis of obtained data gives an opportunity to estimate the plasma parameters of the source region using the theory of MHD oscillations. Periods of registered oscillations vary from several seconds to tens minutes. They are associated with fast magneto-acoustic, slow magneto-acoustic, Alfven and sound waves. There are some mentions (for example Mel'nik et al., 2008) about radio emission oscillations of the type IV bursts at the frequencies 10–30 MHz.

In this paper we consider oscillations of decameter radio emission of the type IV bursts registered on April 7, 2011 by the radio telescope URAN–2. Using Fourier and wavelet analyses we derive characteristic periods at different frequencies.

Observations and results

We registered decameter type IV bursts on the 7th of April, 2011 by radio telescope URAN–2 (Poltava, Ukraine) (Megn et al., 2003). In this day observations by URAN–2 were carried out from 06:12 to 14:02 UT.

There were two coronal mass ejections (CME) on April 7, 2011 according to SOHO. The first one propagated in southeast direction, and the second one moved in southwest direction. The first and the second type IV bursts were observed simultaneously with the first and the second CMEs.

In this paper we investigate oscillations with the largest periods. We used Fourier analysis and wavelet analysis. There are two main long-wave periods. The first one is near 75 minutes and associated with the first and the second bursts. The second long-wave period is near 40 minutes and related to the second event. We obtained that both periods decreased with time. Drift rate of the first period is 0.07. It changes from 88 minutes at the beginning of the first event to 77 minutes at the beginning of the second event and became stable till the end of the second burst. Drift rate of the second period is smaller. Its value is 0.06. This period changes from 47 minutes at the beginning to 38 minutes at the end.

Similar dependencies are obtained in the whole frequency band from 8 MHz to 32 MHz. These results are agreed by both Fourier and wavelet analyses.

Such long periods can be connected with oscillations of the CME core or very high magnetic arches. We show that more possible are oscillations of CME cores and they are associated with magneto-sound or Alfvenic waves. In the case of the first one the temperature of core plasma is $10^6 - 10^7 K$. If oscillations are connected with Alfvenic waves then for magnetic field surrounded the core we have 0.3–0.6 *G*. Both values and plasma density, and magnetic field are seen reasonable.

Conclusion

We discover radio emission oscillations of the decameter type IV bursts registered on April 7, 2011 by the radio telescope URAN–2. Fourier and wavelet analyses show the presence of oscillations with characteristic periods near 75 and 40 minutes. It seems that these are oscillations of CME cores.

References

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